

THE ROLE OF ANXIETY INTO THE SMOKING RELAPSE IN ADOLESCENTS

Patrick Laure

Direction régionale de la Jeunesse et des Sports de Lorraine, Saint-Max Cedex, France

Abstract: Objectives. With tobacco smoking prevention in mind, 1) to compare trait anxiety levels between preadolescents who are beginning with smoking and those who are not, and 2) to measure whether, or not, smoking cessation may influence levels of trait anxiety. **Material and methods.** All of the pupils entering the sixth grade in the Vosges department (France), during the school year 2001-2002 (age: 11) were followed during four years, by questionnaire. Data collected: tobacco use and trait anxiety (Spielberger's State-Trait Anxiety Inventory). Prospective cohort study, by questionnaire. **Results.** There is already a small percentage of regular smokers at age 11 years (3.5 % among boys, 1.2 % among girls). This percentage increases quickly, as well as the quantity of smoked cigarettes. Among never smokers, trait anxiety of preadolescent who will start to smoke within six months, is higher than that of pupils who will remain non smokers, but this difference is not always significant. Among smokers, trait anxiety is higher than among non smokers. Finally, trait anxiety of preadolescents who gave up smoking remained as high as when they smoked regularly. **Discussion.** As in other studies, our regular smokers of both sexes are more anxious than never smokers, and this could underline the anxiogenic influence of nicotine. But these data change at 13 years and after: while girls remain with a high anxiety trait level, the difference disappears among boys. Would girls be more sensitive to nicotine action? **Conclusion.** These findings could constitute arguments to carry out prevention actions intended to reduce anxiety among early adolescent smokers and ex-smokers. As many smokers believe that tobacco has a calming effect, this measure could help them not to start smoking again.

Key words: early adolescents, smoking prevention, anxiety

Rezumat: Obiective. Pornind de la necesitatea prevenirii fumatului, obiectivele studiului au fost astfel definite: 1) de a compara caracteristicile nivelelor anxietății înregistrate la preadolescenții care au început să fumeze și cu a celor care nu fumează și 2) de a măsura dacă stoparea fumatului poate influența sau nu caracteristicile diverselor nivele de anxietate. **Material și metodă.** Toți elevii în departamentul Vosges (Franța), care în anul școlar 2001-2002 intrau în clasa a VI-a (vârsta: 11 ani), au fost supravegheați pe o perioadă de patru prin aplicarea unui chestionar. Informații înregistrate: consumul de tutun și caracteristicile nivelelor de anxietate (măsurarea anxietății după Spielberger Anxiety Inventory). Studiu de cohortă, prospectiv, pe bază de chestionar. **Rezultate.** Exista deja un mic procentaj de fumători permanenți (3.5% dintre băieți și 1.2% fete) la vârsta de 11 ani. Acest procentaj crește repede, și de asemenea numărul de țigări fumate. Printre nefumători, nivelul anxietății la preadolescenții care vor începe să fumeze în următoarele 6 luni, este mai mare comparativ cu elevii care rămân nefumători, dar această diferență nu este totdeauna semnificativă. La fumători, nivelul anxietății este mai mare comparativ cu nefumătorii. În final, nivelul anxietății la preadolescenții care au renunțat la fumat rămâne la fel de înalt ca în perioada în

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care fumau permanent. **Discutii.** Studiul nostru, ca și alte studii în acest domeniu, relevă faptul că fumătorii regulați de ambele sexe sunt mai anxioși decât nefumătorii, acest fapt subliniind influența anxiogenică a nicotinei. Dar sceste rezultate se schimba la vârsta de 13 ani și după: în timp ce fetele rămân cu un nivel crescut de anxietate, diferențele dispar la băieți. Ar putea fi fetele mai sensibile la acțiunea nicotinei? **Concluzii.** Aceste constatări pot constitui argumente pentru elaborarea de măsuri preventive pentru reducerea nivelului anxietății la preadolescenții fumători sau foști fumători. Întrucât mulți fumători consideră că tutunul are un efect calmant, aceste măsuri i-ar putea ajuta să nu înceapă să fumeze din nou.

Cuvinte cheie: preadolescenți, prevenirea fumatului, anxietate

INTRODUCTION

According to the World Health Organization (WHO), tobacco causes 5 million prematurely deaths every year. The majority of adult smokers report initiating tobacco smoking during adolescence. Therefore, this period is often considered to be interesting to study the mechanisms of smoking acquisition and many works have explored, for instance, the psycho-social variables associated with smoking. These data are then used to build prevention campaigns.

One of these variables has been well studied in adult smokers, namely anxiety. Its links with smoking have already been described, even if its basis still remains uncertain. Particularly, the influence of nicotine, which can be either anxiolytic or anxiogenic, depend on the anxiety model tested, the route of nicotine administration and the time course of administration (1).

Among adolescents, data of comparable nature are also available. To define anxiety, a distinction between state and trait has become commonplace. State anxiety is defined by an unpleasant emotional arousal in face of threatening demands or dangers. On the other hand, trait

anxiety reflects the existence of stable individual differences in the tendency to respond with state anxiety in the anticipation of threatening situations (2).

Among adolescents, many studies have linked high trait anxiety to risk behaviors, such as substance abuse (alcohol, cannabis, and other drugs), suicide attempt, dieting and other extreme weight control, but some have not (3-8).

In the field of tobacco smoking, it has been shown that anxiety is associated with higher risk of initiation (9, 10).

Also, young smokers show significantly more anxiety symptoms compared to their non-smoking peers, and tobacco could be used as self-medication for anxiety (11-14). Besides, adolescents who feel relaxed after their first exposure to nicotine seem to be more likely to develop dependence (15).

Finally, many works have reported a transient increase in anxiety following smoking cessation, while others have described a decrease of this factor (16, 17).

These issues could be of practical importance to prevent smoking initiation, to help young people who

are trying to stop, or to help those which stopped not starting again.

However, few data are available on the link between anxiety and tobacco smoking among preadolescents (age: 11 to 14), whereas an important part of them already states to have smoked at least once, would this be only some puffs (18).

The aims of this work, conducted among a large sample of 11 year old adolescents followed up during a four year period, are 1) to compare trait anxiety levels between preadolescents who are beginning with smoking and those who are not, and 2) to measure whether, or not, smoking cessation may influence levels of trait anxiety.

MATERIAL AND METHODS

Subjects have taken part in a prospective cohort study, namely "Bilberries Cohort", which has included all of the pupils entering the first year of secondary school (sixth grade) in the Vosges department (Lorraine region, east France) during the school year 2001-2002 and followed during four years. The data presented in this paper result from a four years follow up period (follow-up began on November 2001 and continued to May 2005)

Methods

Data collection

Data were collected every six months by self-reported questionnaires, designed with an easy answer format.

They were administered by school physicians, school nurses or school social workers and completed at school.

Pupils indicated their number of anonymity, and slid the questionnaire in an envelope, which was sealed at once. Confidentiality and anonymity was assured for the respondents. They were solicited to give honest answers. In the present study, we included subjects who supplied complete questionnaire data and who participated at each of the six data collection sessions.

Questionnaire

The questionnaire, of semi-structured type, was tested beforehand on 120 pupils to ensure the questions were understood and the obtained responses were as accurate as possible.

The final document contained the usual socio-demographic items and included an evaluation of:

- The use of tobacco. Three categories were defined: regular smoker (at least one cigarette daily), former smoker, and never smoker.
- Trait anxiety (TA), measured by Spielberg's State-Trait Anxiety Inventory. State anxiety was not retained, because this variable is too dependent on the situation. Trait anxiety, more stable in the course of time, is the usually used indicator.

Statistical analysis

The data was managed and analysed using the Modalisa ® 4,6 (Kynos, Paris) survey processing software (data entry verified by two operators). According to the nature of the variable, comparisons are made by the chi-square test or by ANOVA, on series paired by pupil. The significant threshold employed was $p < 0.05$.

Subjects' welfare

Study received the approval of the Inspection of Academy of Vosges

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(ethical approval is not required in France for anonymous self-completed questionnaire surveys).

Each headmaster, duly informed by mail, had the choice to participate or not. A letter of information was sent to the parents, who could refuse the participation of their child. Finally, only the voluntary pupils were included in the study.

According to the French law, our computerized files of data were authorized by the NCDL (National Committee of Data-Processing and Liberty).

RESULTS

Description of the respondents

Three secondary schools declined participation in the study.

From November 2001 to May 2005, more than 23,500 exploitable questionnaires were returned.

Overall, 1,230 pupils were present at each of the eight data collection sessions and completed all the questionnaires, representing 9,840 documents.

The responding pupils were made up of 558 boys (45.4 %) and 672 girls (54.6 %). In November 2001, the average age was 11.1 ± 0.5 years (mean \pm standard deviation).

The distribution of the parents' social and occupational groups was similar to the one that is generally found in the Vosges department.

Tobacco use

The percentage of never smokers gradually decreases, in particular in the girls (table 1), as well as percentage of "small" regular smokers (less than 5 cigarettes per day) (table 2).

From Nov 01 to May 03, the number of regular smokers is low (< 100), all the figures were thus rounded.

Table 1. Smoking status of boys and girls (%)

		Nov 01	May 02	Nov 02	May 03	Nov 03	May 04	Nov 04	May 05
Boys (N=558)	Regular smoker	3.5	4.0	5.0	6.1	8.7	11.3	11.5	17.0
	Former smoker	16.5	16.8	18.8	19.6	18.3	20.2	17.3	16.4
	Never smoker	80.0	79.2	76.2	74.3	73.0	68.5	71.2	66.6
Girls (N=672)	Regular smoker	1.2	3.0	5.4	8.7	10.6	14.3	18.0	23.1
	Former smoker	13.3	15.2	18.0	16.6	18.2	20.9	21.2	20.2
	Never smoker	85.5	81.8	76.6	74.7	71.2	64.8	60.8	56.7

Table 2. Number of daily cigarettes smoked by regular smokers (%)

	Nov 01	May 02	Nov 02	May 03	Nov 03	May 04	Nov 04	May 05
< 5	79	74	74	61	69	69	58	57
5 – 19	13	18	18	27	26	19	31	31
20 or more	8	8	8	12	5	12	11	12

Smoking initiation and trait anxiety

This corresponds to 9.8 % of the 1021 never smoker boys and girls (83 % of the population) in Nov 01 and 17.5 % of the 806 never smoker pupils (66 % of the population) in Nov 04 ($p < 0.001$).

Among never smokers, trait anxiety of preadolescent, who will start to smoke within six months, is higher than that of pupils who will remain non smokers. However, this difference is not always significant (table 3).

Regular smoking and trait anxiety

At the girls, trait anxiety is higher among smokers than non smokers, whatever their age (table 4).

Among boys, this difference is observed until 13 years of age, and then it becomes non-significant.

Smoking cessation and trait anxiety

On the whole, 88 girls and 79 boys “regular smokers” stated that they have stopped smoking.

There is no significant difference between trait anxiety of preadolescent who have stopped smoking, and those who have not (table 5). Moreover, those who have stopped smoking were followed up during a 12 months period: they remained anxious.

Table 3. Half-yearly variations of global scores in trait anxiety (Spielberger’s Scale). Comparison between never smokers who have started smoking at M+6 (six months later) and never smokers who remained non smokers (mean age 11.1 years in Nov 01). ANOVA.

Never smokers at M0		Nov 01	May 02	Nov 02	May 03	Nov 03	May 04	Nov 04
Boys	Became smoker at M+6	37.6	37.7	36.5	39.3	37.7	36.8	36
	Remained non smoker at M+6	37.9	35.7 *	35.5	35.4 **	35.8	35.2	35.2
	p	0.06	0.05	0.3	0.01	0.2	0.3	0.2
Girls	Became smoker at M+6	44.8	40.4	42.4	44.6	40.2	46.3	47.7
	Remained non smoker at M+6	40.4 **	38.8	40.1	39.7 **	40.7	41.7 **	41.6 ***
	p	0.01	0.2	0.2	0.01	0.3	0.01	0.001

* $p < 0.05$; ** $p < 0.01$; $p < 0.001$. i.e.: Among never smokers in Nov 02 (M0), trait anxiety of girls who start smoking between Nov 01 and May 03 (M+6) is 42.4, and trait anxiety of girls who remain non smokers is 40.1. This difference is not significant.

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Table 4. Half-yearly variations of global scores in trait anxiety (Spielberger's Scale). Comparison between regular smokers and never smokers. ANOVA.

		Nov 01	May 02	Nov 02	May 03	Nov 03	May 04	Nov 04	May 05
Mean age		11.1 y	11.6	12.1 y	12.6	13.1 y	13.6	14.1 y	14.6
Boys	Regular smoker	40.5	38.2	38.3	38.5	37.9	36.6	35.8	36.7
	Never smoker	37.9**	36.1*	35.6*	35.8*	36.0	35.4	35.3	35.7
	p	0.01	0.03	0.02	0.02	0.06	0.1	0.3	0.2
Girls	Regular smoker	46.3	43.8	44.5	43.8	44.1	44.3	46.2	46.5
	Never smoker	40.8***	39.0***	40.3***	40.2***	40.7***	42.3*	41.7***	42.4***
	p	0.001	0.001	0.001	0.001	0.001	0.03	0.001	0.001

* p < 0.05 ; ** p < 0.01 ; p < 0.001.

Table 5. Half-yearly variations of global scores in trait anxiety (Spielberger's Scale). Comparison between regular smokers who have stopped smoking and those who have not (mean age 11.1 years in Nov 01). Student t-test.

		May 02	Nov 02	May 03	Nov 03	May 04	Nov 04	May 05
Boys	Stopped smoking	41.7	40.8	38.8	38.6	41.9	35.4	41.9
	Remained smoker	39.8	52.2	44.3	39.2	37.3	37.9	37.4
	p	0.4	0.9	0.2	0.5	0.1	0.30	0.1
Girls	Stopped smoking	NS	39.3	43.2	47.6	42.8	45.8	51.4
	Remained smoker	NS	51.3	46.3	47.1	47.3	45.6	46.5
	p	--	0.06	0.3	0.5	0.1	0.5	0.07

NS: non significant (not enough smokers)

DISCUSSION

The main limit of this study is that data were collected on a declarative mode. While this is common method, the investigators do not have the possibility to check the answers. On the other hand, this technique does not seem to disrupt excessively the validity of results even though it seems delicate to generalise them. In our sample, most of the preadolescents do not use tobacco.

However, there is already a small percentage of regular smokers at age 11 years. This is disturbing because smoking one cigarette at this age significantly increases the risk for adolescent smoking, even without smoking in the interim years (19). Thereafter, this percentage increases quickly, in particular in the girls, where it is multiplied by 15 during the 4 years period. Moreover, the quantity of tobacco smoked by regular smokers

increases regularly, although most of them stated that they smoke less than 5 cigarettes per day. These two results are in conformity with tobacco use described by other authors in this age group (18,20).

Patton and al, in their prospective cohort of 14-15 years old adolescents, have found that depression and anxiety, along with peer smoking, predicted initiation of experimental smoking (11). We had observed a similar result among preadolescents (age: 11-12) during a two years follow up: an alteration of their "self-esteem - trait anxiety" profile (global score of self-esteem under the average and/or score of trait anxiety higher than average) predicted the use of tobacco (at least one cigarette) 18 months before taking action (14).

However, in our sample, while trait anxiety of preadolescent, who will start to smoke the next six months, is higher than that of pupils who will remain non smokers, this difference is not always significant. Compared with the above results, this shows that anxiety alone does probably not constitute a useful indicator to predict, or to explain, tobacco initiation.

As in other studies, our regular smokers of both sexes are more anxious than never smokers (13, 21). But these data change at 13 years: while girls remain with a high anxiety trait level, the difference disappears among boys.

Three common hypotheses contribute to explain this fact. The first one refers to a genetic predisposition. A part of the gene that influences activity of the neurotransmitter serotonin could raise

likelihood of nicotine dependence as well as the rate of anxiety. Another hypothesis is that anxious pre-adolescents (as well as adults) use tobacco as self-medication because it could be calming. Moreover, it has been shown that an experience of relaxation in response to the first dose of nicotine is the strongest predictor of dependence (22). Finally, the third hypothesis is that nicotine causes anxiety, by indirectly stimulating the release of dopamine, a neurotransmitter associated with addiction, in the brain's reward centre. And the adolescents' developing brain, gradually, does not manage any more to function normally without nicotine. This process can be very fast: some adolescents begin to experience addiction within weeks of smoking their first cigarette (23). Our findings suggest that this third hypothesis could be retained at age 11 – 12 years, without being able to completely exclude the two first, however. Indeed, whereas some adolescents only are anxious before starting to smoke, they all are when they smoke regularly. This could underline the anxiogenic influence of nicotine. At 13 years and after, would girls be more sensitive to nicotine action? To our knowledge, nothing has been published yet about this question.

Finally, the anxiety of preadolescents who gave up smoking remained as high as when they smoked regularly, but without the transient increase reported by most studies, but not all (16, 17). However, it is possible that this increase, which occurs immediately after cessation, could not be detected

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in our case because our subjects were tested only every six months. This high level of anxiety is of practical importance and could be the subject of prevention interventions intended to reduce it. As many smokers believe that tobacco has a calming effect, this measure could help them not to start smoking again.

CONCLUSION

These findings could constitute arguments to carry out prevention actions intended to reduce anxiety among early adolescent smokers and ex-smokers.

As many smokers believe that tobacco has a calming effect, this measure could help them not to start smoking again.

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